PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
21327WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL 03/00872	09.12.2003	10.12.2002
International Patent Classification (IPC) or both national classification and IPC		
D01F6/04		
Applicant		
DSM IP ASSETS B.V. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
21.06.2004	30.11.2004
Name and mailing address of the international preliminary examining authority:	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Lux, R Telephone No. +49 89 2399-8593

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL 03/00872

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-17 as originally filed.

Claims, Numbers

1-18 received on 20.09.2004 with letter of 15.09.2004

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-18
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-18
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The requirements of Art. 33 (2)+(3) PCT are met for the following reasons:

1. A process comprising steps a) to f) as defined in present claim 1 or steps a) and b) as defined in claim 12 is not disclosed or suggested in the art.
A skilled person seeking for alternatives for efficiently removing a spin finish is not guided by the prior art documents so as to use a "heat-treatment" as specified in step f) of present claim 1 or step b) of present claim 12 (instead of eg washing with water). The surprising advantages, ie the improved efficiency, have been demonstrated with the data of Tables 1+2.

   Therefore, the processes of this application are novel and also based on an inventive step.

2. The spin finish used in the present invention is defined by its **boiling point**, only, ie the claims do not include any chemical structures. Thus, the definitions of the atomic concentrations (at least 95 % C, and at most 5 % O) do not necessarily indicate the degree (the completeness) of the removal of the spin finish, ie these features can be disregarded for novelty considerations of product claims 11, 15 and 17.
Hence, present product-by-process claims 11 and 15 contain two product features which are the tensile strength of at least 30 cN/dtex, and the amount of spin finish residues (ie the amount of polyalkylene oxide derivatives and of potassium).
This combination of features is not disclosed or suggested in the cited prior art.
The unexpected, improved properties (good balance of mechanical properties including "high" tensile strength above 30 cN/dtex) of said products can be taken from Table 1.

   Therefore, the products of claims 11, 15 and 17 and the corresponding uses (cf. claims 16, and 18) are both novel and inventive.

AMENDED SET OF CLAIMS

1. Process for making a polyethylene multi-filament yarn comprising the steps of
   a) spinning at least one filament from a solution of ultra high molecular weight polyethylene in a solvent;
   b) cooling the filament obtained to form a gel filament;
   c) removing at least partly the solvent from the gel filament;
   d) drawing the filament in at least one drawing step before, during or after removing solvent;
   e) applying a spin finish at least once in an amount of 0,1-10 mass% based on the filament, to a filament that contains less than 50 mass% of the solvent; the spin finish comprising at least 95 mass% of at least one volatile compound having a boiling point at 0,1 MPa pressure of from 30 to 250°C; and
   f) removing the spin finish by subsequently exposing the filament to a temperature of below the melting temperature of the filament, such that carbon and oxygen atomic concentrations at the surface of the filament of at least 95 % C and at most 5 % O, as measured by XPS analysis, result.
2. Process according to claim 1, wherein the spin finish comprises a volatile compound that contains in addition to C and H also at least one O atom, or water.
3. Process according to claim 1 or 2, wherein the spin finish is applied to a filament containing less than 10 mass% of the solvent.
4. Process according to any one of claims 1-3, wherein the spin finish is applied in an amount of about 0,2-5 mass%.
5. Process according to any one of claims 1-4, wherein the spin finish comprises at least one alcohol and/or ketone and water.
6. Process according to any one of claims 1-5, wherein the spin finish comprises at least 99 mass% of at least one volatile compound.
7. Process according to any one of claims 1-6, wherein the volatile compound has a boiling point from 50 to 180 °C.
8. Process according to any one of claims 1-7, wherein the spin finish substantially comprises water.
9. Process according to any one of claims 1-8, wherein the spin finish is removed by exposing the filament to a temperature of up to about 5 °C below the melting temperature of the filament.

AMENDED SHEET

AMENDED SET OF CLAIMS (continued)

10. Process according to any one of claims 1-9, wherein removing the spin finish coincides with a drawing step.
11. Polyethylene multi-filament yarn obtainable by the process according to any one of claims 2-10, which yarn is substantially free from spin finish residues, containing less than 500 ppm polyalkylene oxide derivatives and less than 20 ppm of potassium as determined with NMR spectroscopy and NAA analysis, respectively, and which yarn has a tensile strength of at least 30 cN/dtex.
12. Process for converting polyolefin fibres that are substantially free from spin finish residues into a semi-finished or end-use product, comprising the steps of
    a) applying 0,5-10 mass% based on the fibres of a spin finish, which spin finish comprises at least 95 mass% of at least one volatile compound having a boiling point at 0,1 MPa pressure of from 30 to 250°C; and
    b) removing the spin finish by exposing the fibres during or after further converting steps to a temperature of below the melting temperature of the fibres.
13. Process according to claim 12, wherein the spin finish comprises a volatile compound that contains in addition to C and H also at least one O atom, or water.
14. Process according to claim 12 or 13, wherein the polyolefin fibres are gel-spun UHMwPE fibres.
15. Semi-finished or end-use product obtainable by the process according to claim 13 or 14, having carbon and oxygen atomic concentrations at the surface of at least 95 % C and at most 5 % O, as measured by XPS analysis, and containing less than 500 ppm polyalkylene oxide derivatives and less than 20 ppm of potassium as determined with NMR spectroscopy and NAA analysis, respectively.
16. Use of the polyethylene yarn according to claim 11, or the semi-finished or end-use product according to claim 15 in biomedical applications.
17. Biomedical product comprising the polyethylene yarn according to claim 11, or the semi-finished or end-use product according to claim 15.
18. Use of a composition comprising at least 95 mass% of at least one volatile compound having a boiling point at 0,1 MPa pressure of from 30 to 250°C as a spin finish in a process for making polyolefin fibres or for converting polyolefin fibres into a semi-finished or end-use product.